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Peter Lightfoot, Monk of Glastonbury and The Old Clock at Wells.

R. P. Howgrave-Graham.

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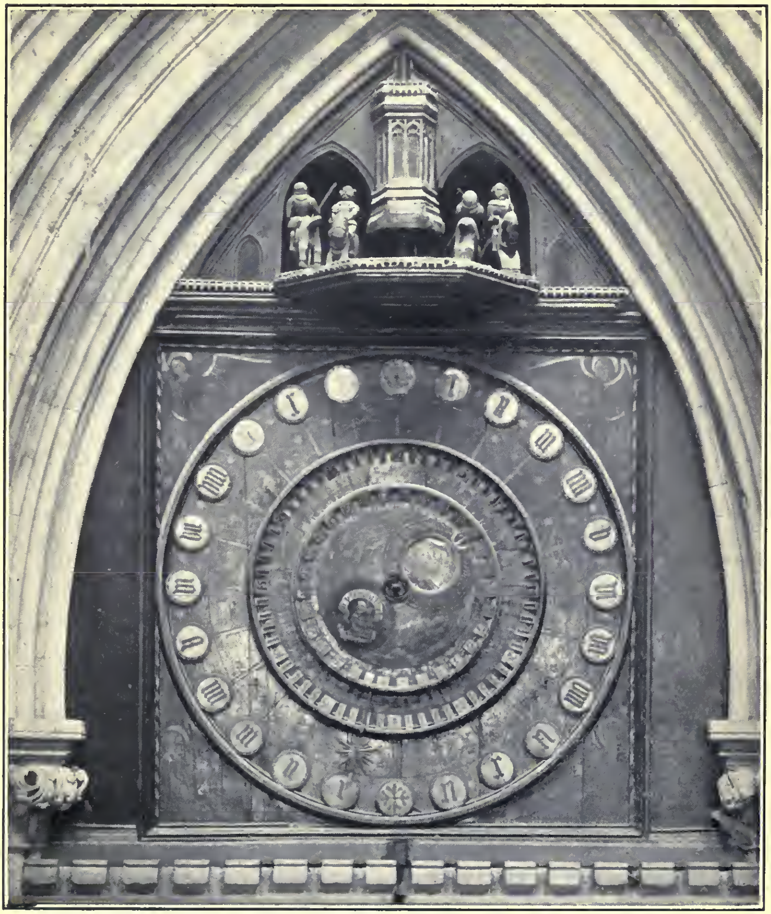
"Time consecrates;
and what is grey with age becomes religion."



FRONTISPIECE.

Plate I.—The Wells Clock: Interior Front.

Photograph by Phillips] [8, Market Place, Wells.

Peter Lightfoot—Monk of Glastonbury

AND

THE OLD CLOCK AT WELLS.

A Poem with an Illustrated Account of the Clock,

BY

R. P. HOWGRAVE-GRAHAM,
M.I.E.E, A.AM.I.E.E.

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THE PRISM.

In Memory of the late Silvanus P. THOMPSON, F.R.S., D.Sc., etc. Scientist, Teacher, Artist, Poet, Musician, and Antiquary.

ONE, lately with us, laid a crystal wedge
Athwart the light of God's unchanging Law
And straight in ordered beauty, through the edge,
There streamed the rainbow's glory and we saw
The clear white ray of Truth disintegrate
In elemental colours whereof each
Component hue made Beauty correlate
With Truth; so did the crystal prism teach
Our eyes to see the light that knowledge brings
"Through the deep mystery of common things."

DEDICATION.

To F.E.G., a Living Friend.

HIM can I praise, whose image in the thought
Of multitudes is treasured, ever clear
As when he lived, whose memory so dear
Some hold that solace can but come unsought
When Time a jewelled gossamer hath wrought
To veil the green remembrance, while the year
Of earthly life creeps on and ever near
They feel the Spring's renewal daily brought.
For Thee, Dear Friend, let Silence with this book
Be bonds of deepest debt and let us tread
The pillared halls of Memory and look
For toys forgotten, music, books we read
Of old, nor grieve that sunlight soon must pass
At Autumn angles through the coloured glass.

PREFACE.

AN ancient attachment to the venerable works of the Wells clock, now exhibited at South Kensington, being kindled anew while I was making a photographic study of Wells and Glastonbury, moved me to write for my own pleasure the lines printed at the end of this volume. A subsequent decision to publish them for the benefit of the Abbey and Cathedral Fabric Funds called for some sort of introduction or annotation, the preparation of which at once revealed so much doubt, difficulty and error in existing records that the proper collection and analysis of available evidence promised results likely to prove valuable to many visitors and to students of archæology or horology.

I would remind all lovers of these places, or any who derive passing pleasure from this book, that we have a great and free heritage in the mediæval buildings raised by our forebears at great cost of labour and ingenuity without such aids as railways or steam cranes. This heritage carries with it a grave responsibility to posterity. Can we, then, withhold the money necessary merely to prevent the decay or oblivion of that which their love and devotion inspired them to build ? I say oblivion, having in mind such work as that of Mr. F. Bligh Bond, F.R.I.B.A., who, with the support of the Dean of Wells and other enthusiasts of the Somersetshire Natural History and Archæological Society, has brought to light buried chapels, monuments, sculptures and encaustic tiles of the utmost interest even to the purely casual visitor at Glastonbury. Excavation, restoration, even mere preservation, are hard problems nowadays; funds are meagre and expenses high, and the smallest help is not too small.

In this era of noble effort for Peace, when a practical idealistic move has been made by the great English-speaking nation in the West, I venture to make a special appeal to Americans who visit Glaston, where was planted the very root of their national Christianity. Let them remember how there sprang from it both the good and the bad in the Old Religion and how their forefathers, inspired by some of its finest ideals, carried the seed westward in the Mayflower to be planted anew. May the fruit flourish and ripen there.

* * * * * * * * * * * * * *

Contributions should be sent by crossed cheque or order, marked "Lightfoot Fund," to The Secretary, Somersetshire Archæological Society, The Castle, Taunton, with a request that it be used for Mr. Bligh Bond's researches.

The whole of the author's profits from this book during the first year will go to the fund, and the portion employed for Glastonbury work will be used at the sole discretion of Mr. Bligh Bond—"him that digs."

I offer my warm thanks to Mr. J. H. Garside, The Rev. Dr. J. Armitage Robinson (Dean of Wells), The Rt. Rev. Dr. H. E. Ryle, C.V.O. (Dean of Westminster), Mr. Ralph Griffin, F.S.A., Mr. J. P. Gilson, M.A. (Keeper of Manuscripts at the British Museum), Mr. F. Parker (of the cathedral), and others for much valuable help with the account of Lightfoot and the Wells Clock. To Mr. Bond I am particularly indebted for much helpful advice and assistance.

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Hampstead, N.W. 3.

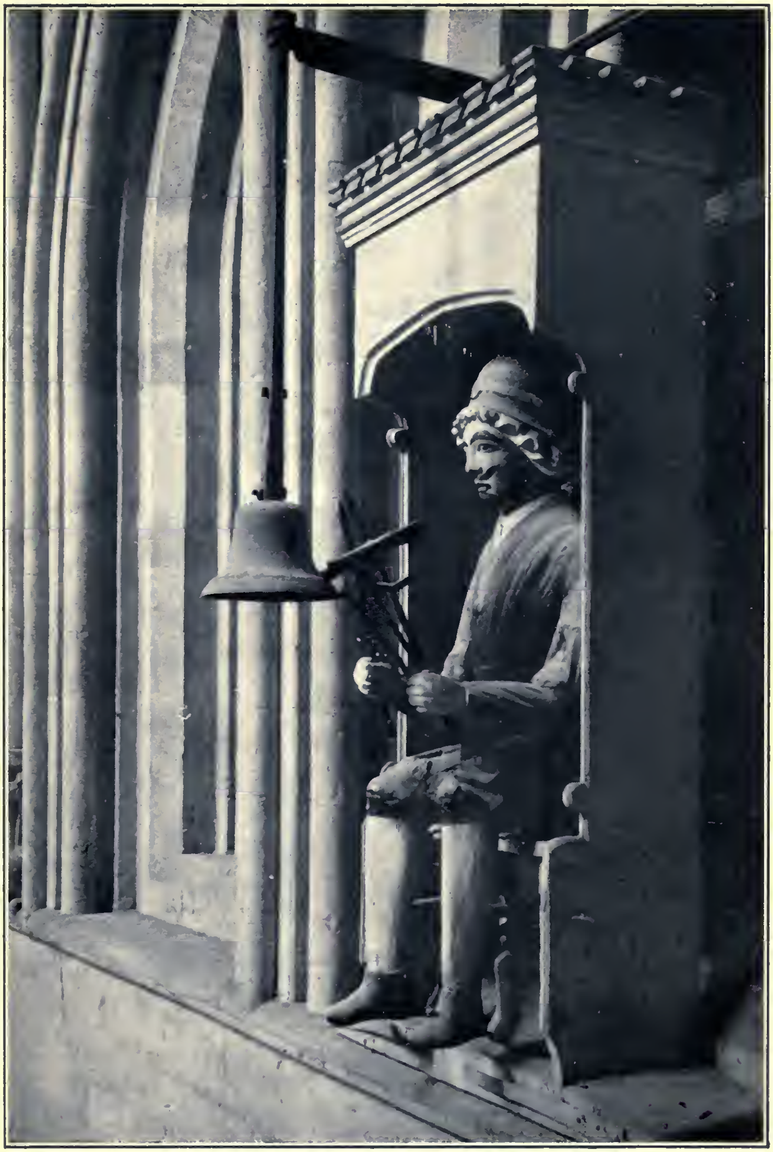


Plate II.—Jack Blandifer.

Photograph by the Author]

INTRODUCTORY ACCOUNT.

PETER LIGHTFOOT AND THE OLD CLOCK AT WELLS.

AMID the teeming memories of Glastonbury and Wells, reaching back into the dim poetic traditions of remote antiquity, certain notable historic and legendary figures stand out with sharp reality in the romantic light of those fierce times—some famous for nobility, devotion and dignity and others for violence, cunning and greed. Such, on the one hand, are King Arthur, St. Dunstan, Abbot Whiting and Bishop Ken, and on the other the violent and masterful Norman Abbot Thurston, or Thomas Cromwell, Dr. Layton and the others who engineered the sham trial and vile judicial murder of Abbot Whiting. In quieter light move the artists and craftsmen, some nameless, but others greatly memorable like Abbot Adam of Sodbury, Bishop Jocelin of Wells, and Peter Lightfoot the Glastonbury monk. Of these the last appears in such tantalizing half-lights of conflicting fact and tradition as seem to have confused even our judgment of the works long associated with his name. Few antiquities can have been so ill-used by writers as the great clock at Wells, and we seek in vain for any real excuse when we remember the easy terms on which its details may be studied.

Here is no crabbed manuscript, accessible only to the learned few in some remote library, but a widely famous treasure placed aloft and well lit so that " lered and lewed " alike may see and interpret it with no subtler aid than is afforded by camera or field-glass.

Some secrets it certainly does hold; others were revealed by the Wells Chapter Rolls, but plain facts are still ignored or distorted, recent discoveries remain in the limbo of unpopularised archives, and absurd errors are handed down and reprinted by successive authors and publishers, whose works leave the ordinary man comfortably misinformed or most uncomfortably puzzled, according to his fortune or perseverance in consulting their contradictory pages.

It was strange to stand for the first time in the transept at Wells after a lifelong and loving friendship with that wonderful assemblage of iron wheels and levers at South Kensington, and to remember that for hundreds of years it had animated the great dials and quaint shows that still attract alike the thoughtful student and the curious tripper to the cathedral.

Fancy had depicted Peter Lightfoot as a mediæval scientist struggling, under the jealous eye of Mother Church, with strange masses of traditional theory in astronomy and astrology, in medicine and quackery, and with systems of sevens and fours in the elements, the seasons, the humours, the winds, the qualities of matter, the ages of man and what not. He would be specially interested, too, in the queer doctrine of the microcosm and the macrocosm which was accordingly introduced in the poem in ignorance of the fact that he who wrote the inscription on the dial at Wells had used the word "*microcosmum*" to explain its relation to the celestial sphere. I hope to show, moreover, that this relationship is even closer than has yet been realized, though it would seem that the association of the existing clock with Lightfoot himself is not nearly so definite as has generally been supposed. It is highly probable, however, that the work followed very similar lines of construction and detail to those used by that famous craftsman, and we may fairly believe that, in part at least, the great *horologium* is the outcome of his genius.

MEDIÆVAL CLOCKS.

At least as early as the eleventh century monasteries were provided with weight-driven clocks, though it is probable that these had no dials and merely struck bells at intervals to call the monks to prayer. F. J. Britten in "Old Clocks and their Makers" tells us that in the Rule for Citeaux, of 1120, the sacristan has the duty of adjusting the abbey clock to awaken the monks for Matins, and the very word "clock," originally meaning a bell (cf. *cloche*), has come down through the ages to remind us of this early usage. St. Paul's had a clock-keeper in 1286, Westminster in 1290, Canterbury in 1292 and Exeter in 1318; Abbot Richard Wallingford made a famous astronomical clock for St. Albans between 1326 and 1334, and it has been suggested that some of the early clocks were designed as much for demonstrating the motions of the heavenly bodies as for showing the time. Clocks were formerly called *horologia* or *horologes*, and in Chaucer's description of the cock we find the following:—

"   . . . . . .a cok, hight Chauntecleer,
In al the land of crowing nas his peer.
His voice was merier than the mery orgon
On messe-dayes that in the chirche gon;
Wel sikerer was his crowing in his logge
Than is a clokke or an abbey orlogge."

SCIENCE IN THE THIRTEENTH CENTURY.

It is of the greatest importance and interest to review the general condition of scientific knowledge during the period in which the Wells clock was made, because the prevalent cosmic conceptions took an even more prominent place than has been fully realized in the mind of the craftsman who built this famous horologe. We may suppose that Peter Lightfoot himself glorified his work at Glastonbury with a representation of the planetary system in some more or less crude form, whether or no he personally made the actual existing clocks traditionally assigned to him.

The wonderful thirteenth century, to which we owe the highest developments of Gothic sculpture and architecture, also produced a group of scientific men whose breadth of outlook and methods of investigation heralded the dawn of modern research and discovery. Ecclesiastical opposition and the general decay of intellectual enthusiasm clouded the sky only too soon, and it was not until the close of the Middle Ages and the advance of the Renaissance that the fresh winds of new thought and intellectual criticism from such men as Copernicus, Gilbert and Galileo swept away the gathered mists of mediævalism and revealed the sun already high and mounting in the heavens.

Roger Bacon.

Roger Bacon, the greatest of the thirteenth century scientists, who began to take an active part in the movement in about 1235, was a student at the University of Paris, where he also gave many courses of lectures and eventually became Regent Master. In 1267 he tells us that he had then spent on manuscripts, instruments and other scientific aids a sum equal to £10,000 of our present money. His optical discoveries are famous and his attainments as a linguist and mathematician, great as they were in themselves, served also as instruments for the expression of a highly original genius which was active in many directions.

In 1266 the Pope ordered him to send secretly to Rome one of his great works, the *Opus Majus*, and it is to this command that we owe its preservation. Other works seem to have been sent subsequently, but the Pope died in 1268, and the papal interest in Bacon's teachings seems to have ended here. In 1278 Bacon was imprisoned for some " suspected novelties " by the Minister General of the Franciscan Order to which he belonged. It is believed, on no definite grounds, that he was in prison until 1292, when he wrote his last and never-completed piece of work.

He was the first great English scientific thinker and experimentalist, a fearless fighter for new ideas and the establishment of Truth, regardless of time-honoured authority, and a champion of experiment as opposed to tradition. He was also a pioneer of textual criticism, and had the courage to grapple with the corruption of the Vulgate Bible then accepted by the Church.

MEDIÆVAL ASTRONOMY.

At this period the common conception of the Universe was that set forth by Claudius Ptolemæus, about A.D. 139, in his greatest work, "The Almagest." In his view the immovable spherical Earth was the central body and each planet moved within a sphere which was in its own special heaven, all the more obvious motions of the planets being explained by the theory of epicycles and eccentrics current at the time. Bacon knew that the Earth was a mere dot in the vast astronomical system.

The heavens were concentric hollow spheres round the Earth, disposed after the fashion of an onion's layers and their apparent daily rotation, really due to that of the Earth about its own axis, was caused by a sphere called the "Primum Mobile," situated beyond the fixed stars and between them and the Empyrean Heaven where God and His angels dwelt.

This belief is clearly shown in Fig. (1, p. 20) where, outside the elemental spheres, (more fully dealt with on page 23,) the heavens are shown in order of distance which accords with modern knowledge. The Sun counts as a planet and his heaven lies between those of Venus and Mars. Beyond Saturn's sphere is the 8th Heaven, that of the firmament of fixed stars, and the 9th or special Crystalline Heaven arose out of attempts to explain the precession of the equinoxes discovered by Hipparchus in the 2nd century B.C.

The naive literalism of the Middle Ages materialized these geometrical conceptions and all the spheres became crystalline. Blundevile in his "Exercises" (1606 edition) says:—"They are all cleare and transparent like fine birall glasse, or Christall; through the which the sight doth easily pearce, though there were never so many coates of such cleare substance, covering one another like the skales of an Onion; for so the heavens doe cover and enclose one another and every one is of an exceeding great thickness." He follows this up with dimensions of the spheres and of the Sun, Moon and planets, the values being in many cases remarkably good. The motive power of the Primum Mobile was sometimes supplied by the quaintest devices, such as angels grinding crank-handles fixed to the celestial poles as to a churn, or the third person of the Trinity rotating the spheres with his feet—a conception that is compatible with a rather better type of mystic symbolism.

According to another notion the rotation was maintained by the four chief winds, commonly shown as men's faces, or as symbolic animals' heads blowing very palpable looking wind-blasts tangentially to the celestial spheres. In the visions of St. Hildegard of Bingen, 1098-1180, is this passage:—"I looked, and behold the east and south winds with their collaterals, moving the firmament by the power of their breath, caused it to revolve over the earth from east to west; and in the same way the west and north winds and their collaterals receiving the impulse and projecting their blast, thrust it back again from west to east." Hildegard even associates the lengthening and shortening days of the seasons with the winds and their collaterals driving the firmament alternately northward and southward. Such views, however, must not be taken as the theories generally accepted in the 13th century and after, when the influx of Arabic knowledge firmly established the main features of the Ptolemaic System. From that time onward the winds were often shown in drawings of the Universe, but they were seldom its motive force. See "Studies in the History and Method of Science" by Dr. Charles Singer (Oxford University Press, 1917.)

Dante transcends all such ideas in one of his most exquisite and deeply mysterious passages, where he ascribes the whirling of the vast system to the Primal Love which moves the whole Universe.

The spheres were supposed by Pythagoras to emit certain characteristic musical harmonies, an idea which was elaborated by Kepler hundreds of years after Bacon's death.

Another accepted doctrine, that of the "Microcosm and the Macrocosm," taught that the organs and parts of the body were associated, not only with the four bodily humours—"Blood," "Phlegm," "Red Bile" and "Black Bile," and with their corresponding temperaments in man, but also with the different heavenly bodies, among which each was believed to have a counterpart: the doctrine was interwoven with the teachings of astrology and included the converse notion of "The Universe as a man," the association between the great and the little being deeper and more mystic than a mere modelling or patterning of the one upon the other.

Paracelsus, in the 16th century, held the microcosm and the macrocosm to be not only comparable but identical—a unity of two things divided only by form. This is merely a completion or extension of the idea contained in the earlier doctrine.

PETRUS PEREGRINUS.

Petrus Peregrinus de Maricourt (*Magister Petrus de Maharne Curia*) was a scholar-soldier of Picardy, for whose scientific method and attainment Bacon expressed the highest admiration.

While engaged, probably as a military engineer making trebuchets or other engines, at the siege of Lucera, he wrote from the trenches to a friend the famous letter dated 12th August, 1269, in which he described a series of experiments on lodestones and magnetic compass-needles. The work is full of important facts, theories and suggestions, the chief feature in the mind of Petrus himself being his attempt to devise perpetual-motion machines, a thing easy enough to laugh at in the light of modern knowledge and experience.

One of these, a sphere of lodestone (or natural magnetic rock) arranged as described below was regarded as a model, counterpart or microcosm of the celestial sphere, and he expected that it would rotate in harmony with the Primum Mobile and fixed stars once in twenty-four hours, so providing a perpetual clock needing no winding.

The late Professor Silvanus P. Thompson, a famous historian of early Science, gives the following in a delightful translation of Peregrinus printed at the Chiswick Press in Caxton type, 1902:—

" From these facts therefore it is manifest that it is from the poles of the heavens that the poles of the magnet receive their virtue. But you may reckon that the remaining parts of the stone receive their influence from the other parts of the heavens: so that in this way we may suppose not only that the poles of the stone receive their influence and virtue from the poles of the world, but that the whole stone does so from the whole heavens; which I advise you to test in the following manner."

There follows a description which is closely followed in the poem printed in this volume, and then there is this naive admission:—

"Now if the stone then move according to the motion of the heavens, rejoice that you have arrived at the secret marvel. But if not, let it be ascribed rather to your own want of skill than to a defect of Nature."

For further information on Peregrinus see "Petrus Peregrinus de Maricourt and his *Epistola de Magnete*" by Silvanus P. Thompson: Proceedings of the British Academy. Vol. II., 1906, Oxford University Press.

PETER LIGHTFOOT.

CLOCKS AT GLASTONBURY AND WELLS.

Such were the scientific ideas prevalent when Peter Lightfoot, formerly accepted as the maker of the famous clock at Wells, was a monk at Glastonbury.

Our knowledge of the man is slight. A strong and widespread tradition assigns to him the clocks at Wells and Wimborne and even one at Exeter, and there is a reference by Leland the antiquary, who wrote in the middle of the 16th century, saying of Glastonbury Abbey:—*Horologium Petrus Lightfote Monachus fecit hoc opus.*

Of Lightfoot's abbot, Adam of Sodbury, Mr. F. Bligh Bond, the present enthusiastic excavator at the Abbey, writes as follows in his "Architectural Handbook of Glastonbury Abbey":—"He did much for the Abbey. We are told that he vaulted the greater part of the Nave and ornamented it with beautiful paintings. . . . Under his rule were also provided the large clock (*horologium*) for which the Abbey was famous, the bells, seven in number, which were in the central tower, and five in another tower." He also gave a great organ and various altars and ornaments.

This information is taken from the monastic chronicler, John of Glaston and, with Leland's reference it provides fair evidence that Lightfoot made the Glastonbury clock under this artistic and enterprising abbot in about 1325.

Recent knowledge, however, completely disposes of the old theory that Lightfoot's clock at Glastonbury was removed to Wells at the Dissolution in 1539, and it is somewhat strange that antiquaries have believed that the clock now at Wells was made for any other position than its present one. The matter is partly dealt with by Canon C. M. Church, M.A., F.S.A., in his valuable and interesting paper on the subject, and he not only shows how unlikely it is that the "lewd fellows of the baser sort" who sacked the Abbey for jewels and precious metals would trouble about an ancient clock, but he has proved the existence of a clock at Wells long before the Dissolution. He quotes from the Wells Rolls of 1394-5 items of payments which are repeated continuously in all extant Rolls throughout the 15th Century:—

in stipendium custodientis la clokk x s. per annum. "To the keeper of the clock 10/- per annum."

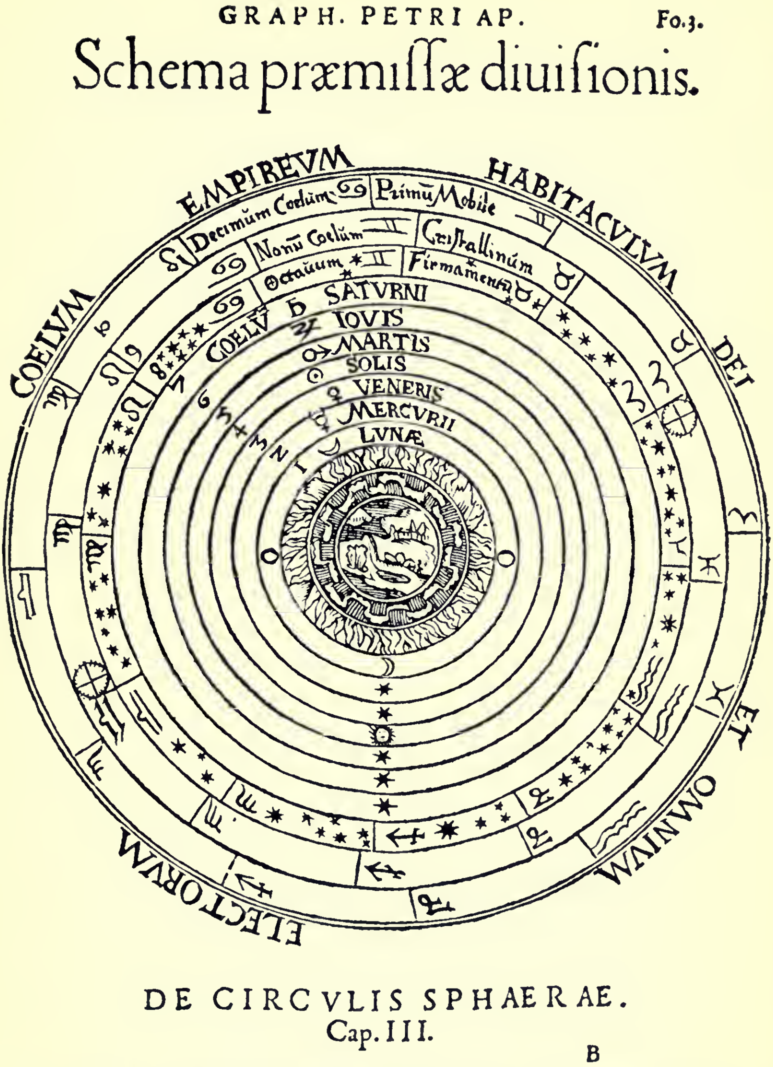
This delightful entry reminds us of the money accounts for decorating and painting St. Stephen's Chapel at Westminster in Edward III.'s reign. A pigment was formerly extracted from cloth dyed with kermes red, and accordingly we find an item of 2/7d. for *unum scarletum blanketum.* Another is 8d. *Pro reparatione brushorum.*

It is impossible to resist quoting yet another instance given to the writer by the Rev. W. Hudson, F.S.A., from a 14th century money account.

Item:—duobus aurigis pro querend brokele.

Done into English this is literally:—

"Item. Two charioteers for fetching brokele 2/8."



GRAPH. PETRI AP. Fo.3.

Schema præmiſſæ diuiſionis.

DE CIRCVLIS SPHAERAE.
Cap. III.
B

Fig. I.—The Ptolemaic Universe as Represented in Mediæval Times. From Apian's Cosmography, 1545.

Photograph by the Author]

This has no reference to broccoli, "brokele" being an old English word for broken debris or rubbish, and it is interesting to learn from my friend Lieut. C. A. Boraston that the men in a northern regiment regularly called the dirt-tub the "brock tub" or the "brock barrel." Hence the item is really for a couple of farm carters to fetch rubbish.

To return to the Wells rolls:—

"The great organs" required only 6/- per annum for their upkeep and considerable as these sums were at this period, we see that the clock made the more important and expensive item. Canon Church considers that the Wells horologe corresponds fairly well to John of Glaston's description of Peter Lightfoot's clock at Glastonbury:—

Magnum horologium processionibus et spectaculis insignitum. He translates this:

"A great clock distinguished by shows and figures in motion"—but the *processionibus* may have meant something more elaborate than we have at Wells, for in 1340 Cluny had a clock which acted several biblical and religious scenes and was fitted with moving animals and carillons.

We cannot prove or disprove by documentary evidence Peter Lightfoot's traditional authorship of the existing clocks at Wells and Wimborne. The first-named may have been begun by him and finished by later hands, but the author thinks that it was probably built expressly for the Cathedral by monastic craftsmen of his school at Glastonbury near to the end of the fourteenth century. In support of this theory we have firstly the established fact that he made the earlier Glastonbury clock, secondly the very strong tradition connecting the Wells and other clocks with him, and thirdly the improbability that there would be an established cloistral craft of clock-making in a community of secular canons such as existed at Wells. It is just possible, however, that such work might have been attempted by local or imported craftsmen in the cathedral city, as suggested in the opening lines of the poem.

The attribution of the less ambitious Wimborne clock to Lightfoot seems even more incompatible with its general style, but the tradition is so strong as to enforce the belief that the monks at Glastonbury carried on the Lightfoot workshop for some time after his death, their products being known as Lightfoot clocks because of the fame of the pioneer artist. Such usage has its parallel at the present time when we buy "William Morris" wall-papers or erect "Kempe" windows in churches.

THE SCREEN.

An important evidential feature that appears to have received rather scant attention before is the stone screen occupying a large part of the bays on the West side of the Transept. It seems obvious that this either existed before the clock was installed, or was erected for the express purpose of supporting its front and enclosing its works; these were further protected behind by mediæval painted boarding ornamented with what appear to be red and white roses and foliage.

Though the painting may belong to a later period, the stone screen is of early Perpendicular design. It does not enable us to say positively that the clock is not later than about 1400, though its detail strongly suggests that period; but it does afford strong reason for thinking that the clock cannot be earlier than about 1380. On the whole it supports the idea that the screen and the main features of the clock were erected together shortly before 1394. In this conclusion Mr. Bligh Bond and Mr. Griffin concur.

THE ELEMENTAL SPHERES.

Passing to the actual details of the dials and "shows" in the north transept we find the prevailing astronomical ideas of the period taking a more prominent place than has hitherto been perceived. A ball, representing the earth, occupies the centre of the face and is surrounded by a small crown of wavy sculpture somewhat resembling the leaves of a rose. (Frontispiece.) The author has not seen any reference to this, but believes that it represents the sphere of air and perhaps that of fire that surrounded the earth between it and the moon's sphere; the crinkled or wavy device—the recognised conventional emblem for clouds and for the sphere of air appears clearly in Fig. 1 (p. 20), with flames surrounding it, and though the fiery sphere is not separately apparent at Wells it may have been omitted as less tangible than the cloudy air. Fig. I. was taken from *Cosmographia* by Petrus Apianus, Antwerp, 1545, and the text referring to it runs: *Mundus bifarium dividitur, in Elementarem regionem, & Aethercam. Elementaris quidem assiduem alterationi subjecta, quatuor Elementa, Terram, Aquam, Aerem, & Ignem, continet. etc.*

Similar but more explicit descriptions are given in Sacrobosco's book on "The Sphere."

Referring to a figure of the same type Blundevile makes his questions and answers thus:—

> "What doth the Elementall part containe ?
> It containeth the foure Elements.
> Which be those ?

The Element of the fire, which is next to the Spheare of the Moone, and next to that more downward is the Element of the aire, and next to that is the Element of the water, and next to that is the earth, which is the lowest of all.

All which things you may see heere plainely set foorth in this figure following on the other side."

Blundevile gives another figure showing these lower spheres by themselves in his "Second Booke of the Spheare," and this resembles the sculpture in question even more closely.

The elements had four qualities that were closely related to the heavens, the four winds, the four humours, the four ages of man, the four seasons, etc. Earth was cold and dry, water was cold and moist, air was hot and moist, and fire was hot and dry.

The following doggerel passage shows how mediæval scientific thought treated the problem of the irregularly distributed water and earth, forming together a sphere which did not quite happily harmonise with the tradition of a perfect concentric arrangement having the earth at the centre and, outside it in order of their densities, the spheres of water, air and fire. The work from which it comes is "A new interlude and a merry of the nature of the four elements." Its date is C. 1510-37, and it is given in partly modernised spelling:—

"The great world behold, lo, divided wondersly
Into regions whereof one I call
The etherial region with the heavens high,
Containing the planets, stars, the spheres all;
The lower region called the elemental
Containing these four elements below
The fire, the air, the water, the earth also.

The earth of itself is ponderous and heavy,
Cold and dry of his own nature proper;
Some part beth dry continually,
And part thereof covered over with water,
Some with salt sea, some with fresh river,
Which earth and the water together withal
So joined make a round figure spherical;
So the water which is cold and moist is found

In and upon the earth filling the hollowness,
In divers parts lying with the earth round
Yet the hills and mountains with the earth
excess
Take nothing of it away the roundness,
In comparison because they are so small
No more than the pricks do that be on a gall."

Dante and others held that a single and nearly continuous mass of land was opposed at the antipodes by a vast ocean in the midst of which, and diametrically opposite to Jerusalem, was his Mount of Purgatory. Altogether there was much contradiction as to the nature of the unexplored half of the terrestial sphere.

THE MOON-PLATE.

Round the elemental spheres at the centre of the face is the moon-plate,—a rotating disc which is pierced with a large eccentrically placed circular hole, and through this the phases of the Moon are shown by the moon-disc, beginning with a gold crescent, which grows until the whole opening is backed by gold at full moon, and, in due course, wanes. (Frontispiece.)

THE INSCRIPTION.

A legend in Gothic letters surrounding the moon-disc is probably an untouched feature of the original clock, the lettering being of a style near to the date 1400; it is thus rendered in Canon Church's paper:—

"*Sphericus Archetypus hic monstrat Microcosmum.*" Strangely enough Dr. Armitage Robinson, the present Dean of Wells (but of Westminster at the time) discovered a reference by John Flete, a monk of Westminster Abbey, 1420-1425, to a similar inscription on the Abbey pavement. This is given in the Dean's reprint of Flete's History of the Abbey, which contains accounts of various objects of interest there. While at work on the History, Dr.

Robinson noticed the similarity of the inscription to that on the Wells clock and requested Canon Church to make a fresh examination at Wells; this revealed part of the word "globus," most of which is hidden by the model of the elemental spheres through or behind which the inscription passes, and it also showed that the word formerly given as "archetypus" is really "archetypum"; thus the inscription, with its abbreviations expanded, became:—*Sphericus archetypum globus hic monstrat microcosmum.* The words quoted from the monk John Flete refer to certain decorations on a pavement laid down in front of the High Altar at Westminster in the time of Abbot Ware A.D. 1268, and are as follows:—

Versus in prædicto pavimento circulariter scripti . . . . . Sphericus architypum globus hic monstrat macrocosmum.

This inscription surrounded a representation of the Ptolemaic Universe and the translation of it makes plain good sense:—

"This rounded globe represents the original macrocosm." Or as the word *archetypum* is known to have been used occasionally as a substantive the rendering might be:—

"This rounded globe represents the Macrocosm-(great Universe) its archetype."

The references to the use of "*archetypum*"-*i*" neuter, as a substantive in Lewis and Short's Dictionary, suggest that in Classic times the meaning would scarcely permit this interpretation, but it may nevertheless be possible as a mediæval usage.

Returning to the Wells inscription we are at once confronted with a difficulty, for if we assume the same formation of sentence the only possible interpretation is:—

"This rounded globe represents the original microcosm."

In considering this there are two things of which we may be quite sure:—(1) that he who was responsible for the words did not mean to make the absurd statement that a microcosm was the original or archetype of which the clock was a model, and (2) that he used the words *sphericus globus* to embrace the whole dial with sun, moon and starry firmament.

Such an interpretation therefore would be nonsense from the mediæval standpoint, and the author has sought various avenues for escape through corrupt mediævalisms, etc., thinking that the blurred termination of *archetypum* might prove it to be nominative and not objective, or that the hidden part of *globus* might yield some other sense.

A possibility is that *archetypum* is here a neuter noun in the nominative case as suggested above, *hic* being an adverb. If then *archetypum* were in apposition we should have:—"The spherical globe, the archetype, here shows a microcosm." Mr. J. P. Gilson thinks this rather unlikely, but suggests that it is just possible to construe *microcosmum* so as to give this result:—"This rounded ball (or globe) exhibits its archetype as a world in miniature."

Mr. Gilson likes neither of these versions, and if they are wrong we are driven to the conclusion that the artist simply blundered and wrote *macrocosmum* for *microcosmum*. Such mistakes were common enough, and we may suppose that he had seen the much earlier Westminster inscription, or a manuscript of some work in which it occurred, and from which the Westminster folk took it, and had copied it carelessly with the more familiar word *microcosmum* already in his mind.

It is quite likely that the Westminster and the Glastonbury craftsmen got the words from some common source through different channels, and that the version seen by the Glastonbury artist was already corrupt. It may even be that Lightfoot used the correct words on the lost Glastonbury clock, and that his successors garbled them in ignorance when engaged upon the later work for Wells.

Recent enquiries made by the author gave him the mistaken idea that no vestige remains of the inscription on the pavement at Westminster, but since the above account was written a further complication has been introduced as a result of referring to Mr. Francis Bond's "Westminster Abbey," in which there is an interesting note with a plate showing the Mosaic pavement called *Opus Alexandrinum* laid down in front of the High Altar by Abbot Ware and Ordericus of Rome in 1268.

This beautiful pavement in the Italian style, resembling work at St. Mark's, Venice, Murano, Torcello and Canterbury, is that described by Flete, and the plate shows a central disc surrounded by four concentric circles of patterning, which has almost disappeared. The two innermost circles are marked *k*, and beneath the drawing, amongst a number of specimens with reference letters, is found a double band of six-pointed stars (*k*). There is no other star-pattern quite like this, and it is obvious that the stars are astronomical, while the centre of the pavement forms an extremely crude representation of the Ptolemaic Universe.

Surrounding the circles is the mutilated inscription. Strangely enough it reads: " . . .(*re* ?) . . . . *monstrat microcosm*. . . ."

Here is direct contradiction of Flete's account, but agreement with the Wells inscription!

The author wrote at once to the Rt. Rev. Dr. Ryle, Dean of Westminster, who most kindly had the carpet taken up and, with Canon Barnes and the Sacrist, Mr. Perkins, examined the pavement carefully.

The following is given in Dr. Ryle's own words, a few lines being omitted where they repeat something already stated.

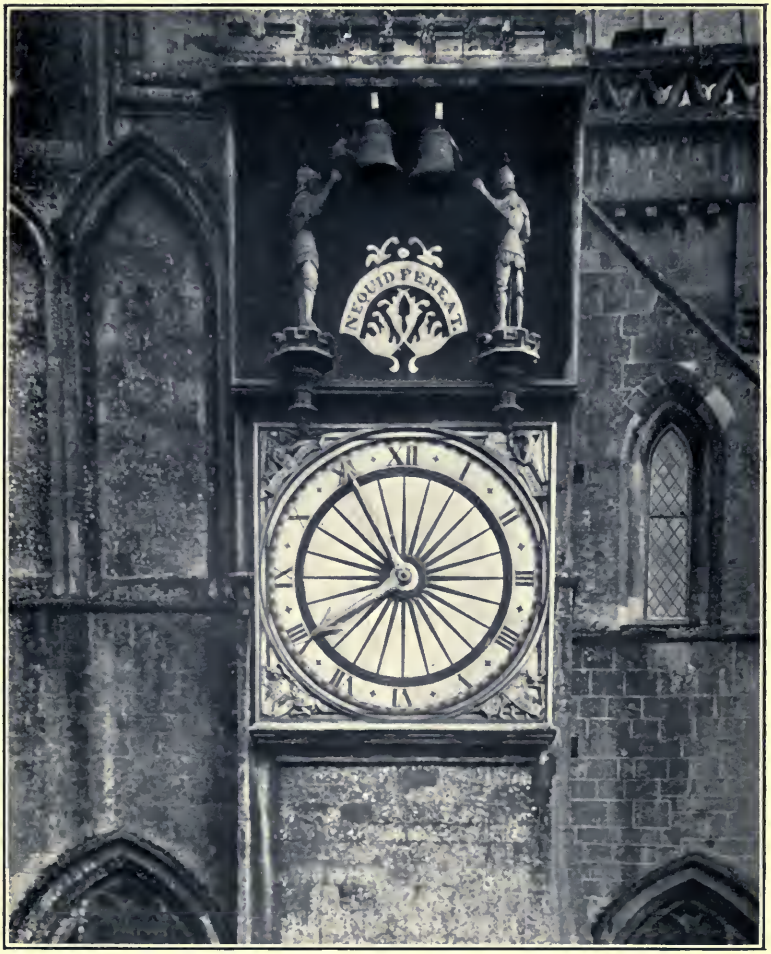


Plate III.—Exterior Face of Clock.

Photograph by the Author]

(1) " The inscription is much defaced. Only two or three bronze letters survive; but the matrix remains of several letters.

(2) " It is quite easy to make out M . . .(COS) MUM, but the letter and the matrix of the letter following the initial M have been entirely obliterated.

(3) " The inscription is in the form of a circle, and all round are circles, in a highly complicated design.

" The results of our inspection satisfied us that the second letter has gone beyond recognition as A or I. There would be room for an A, but the stone has crumbled so much that the possibility of recognizing the remains of a vertical I is lost. The R. of *Archetypum* and the MON of *Monstrat* are survivors."

Now such letters as remain according to the plate in Mr. Bond's book are clear and sharp. Is it likely that under modern guardianship so much further mutilation would have occurred between the preparation of this plate and Dr. Ryle's examination ?

Moreover, the E following the R as quoted above seems altogether unreasonable. Surely then the artist who drew the plate blundered and the I in his " *microcosm.*" was a guess.

The author believes that the monk Flete gave a true description, and that the plate-artist fell into the same error as his mediæval predecessor at Wells, and should have used the less familiar word *macrocosmum.* Perhaps the settlement of this baffling and elusive question lies on a time-worn marble pavement in Italy, or hides in a manuscript or even shows boldly on the face of a mediæval clock in some collection.

Before the author paid much heed to the words he was puzzled by an inscription quoted in a local guide as existing on the Wells dial, but vaguely suspected it to be a debased version of the words discussed above. Mr. J. H. Garside, when his attention was drawn to this, wrote the two sentences round a circle, making the guide-book version begin where the syllable *typum* occurs in the correct inscription, and Fig. 2 shows the charming result, stars having been placed to mark the commencement of each version. The garbled words are *Punctus ab hinc monstrat micro sidericus arcus.*

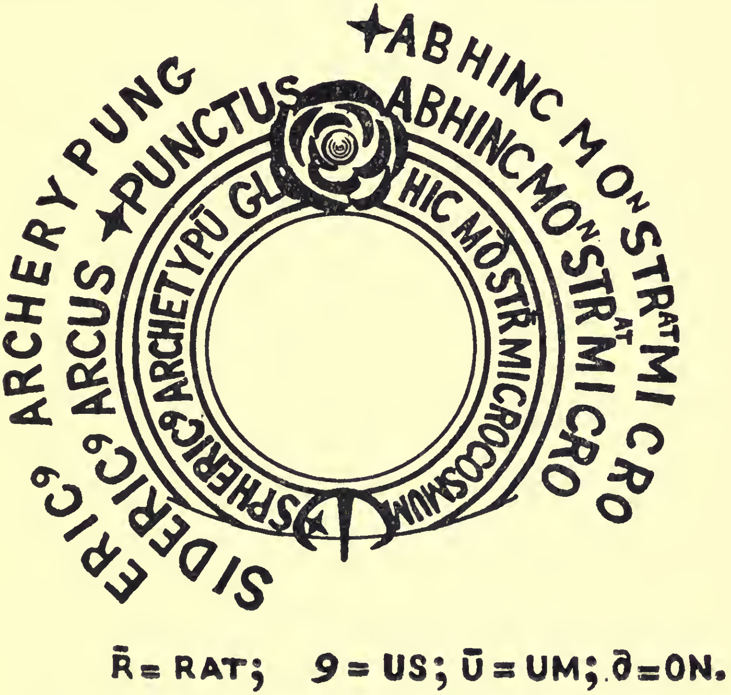


Fig. 2.—True and Garbled Versions of Moon-plate Inscription.

It matters little who originated this amusing absurdity, but it seems strange that an important sentence, easily legible with the exception of a few letters, should have been the victim of such quaint guess-work, and should so remain in print.

Britten describes the words as "not very intelligible," and tells us that one author reads them thus:—*Ab hinc monstrat micro* . . . *ericus* . .

archery pung, "meaning probably that in this microcosm were displayed all the wonders of the vast siderial hemisphere." This inscription also is shown in the figure; its translation puts a severe strain on the ridiculous words quoted but probably conveys a fair idea of the intended meaning. Britten is rightly cautious, but these versions should provide an instructive lesson to other authors and publishers who quote without verification.

THE MOON'S AGE.

For the sake of brevity the name "moon-plate" is given to the innermost disc which carries the moon and the figure of Phœbe, with their respective inscriptions. It is surrounded by a ring in which the age of the Moon is set out in Arabic numerals up to 30 days, the period of the lunar month. This ring revolves once in 24 hours, and the moon-plate is carried round with it at a slightly lower speed; the small difference is sufficient to make it lag 12° in 360°, the result being that a "buckle-shaped" pointer attached to it moves backwards with reference to the lunar days, and indicates in a counter-clockwise direction an advance of one day out of the 30 lunar days during every 24 hours.

THE HORARY DIAL, THE SUN, AND THE POINTERS.

Attached to the rotating ring is a bar which is bent or arched so as to clear a second fixed projecting ring of larger diameter, and is terminated by a large "star"; one ray of this indicates the hours of the day on the horary dial or outermost range of numerals. The rotation of the "star" with the ring that carries it, being completed once between midnight and midnight, it follows that the horary numerals constitute a 24-hour dial, though, unlike a modern 24-hour-dial clock, the numerals here run from midnight to noon, where there is a cross, and are then repeated through the other half of the circle, as may be seen in the Plate. The significance of the "buckle" and "star"-shaped pointers has evidently escaped notice like so many other features of the horologe, but those who are familiar with the beautiful old clock by Isaac Habrecht of Strassburg, 1589, now in the British Museum, will recognize that the following is a reasonable explanation. Habrecht's clock has a horary dial arranged in two semi-circles of 12 hours each, exactly as at Wells, but the indicator consists of a pointer or hand that crosses the dial diametrically so that each end reads the same hour on opposite semi-circles at any given instant. Near one end is a large "star," very like that at Wells, but unmistakeably intended for the Sun, as the middle shows the traditional broad smiling face. The rays are of varying length like those at Wells, but differ from them in being wavy. The conclusion drawn from this, that the "large star" represents the Sun as well as performing the service of a pointer, makes it seem almost ridiculous that such an obvious meaning has been missed.* What more that so early a craftsman could achieve is wanted to complete his microcosm, for this sun rotates round the Earth once in 24 hours in accordance with the geocentric conception, and lies between the moon-disc and the starry firmament? Again, the hand of the Museum clock has a crescent moon at its other extremity; surely then the "buckle-shaped" pointer is merely a small crescent moon with a pointer projecting from its concave side, and is there to indicate that the pointer shows the Moon's age in "lunar days." Intermediately between the ring of days and the horary numerals is a ring divided into 60 parts, each fifth division being numbered. A small star, carried by an arm concealed behind the moon-plate, and operated from the central arbour in the mechanism at the back, indicates the minutes, making a whole revolution in one hour. Its rate of movement, being comparatively high, it does not appear in a photographic exposure of any considerable duration, and even the moon-plate is commonly blurred, though it revolves only once in a day.

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* After going to press the author noticed in existing works two vague references that might convey this meaning.

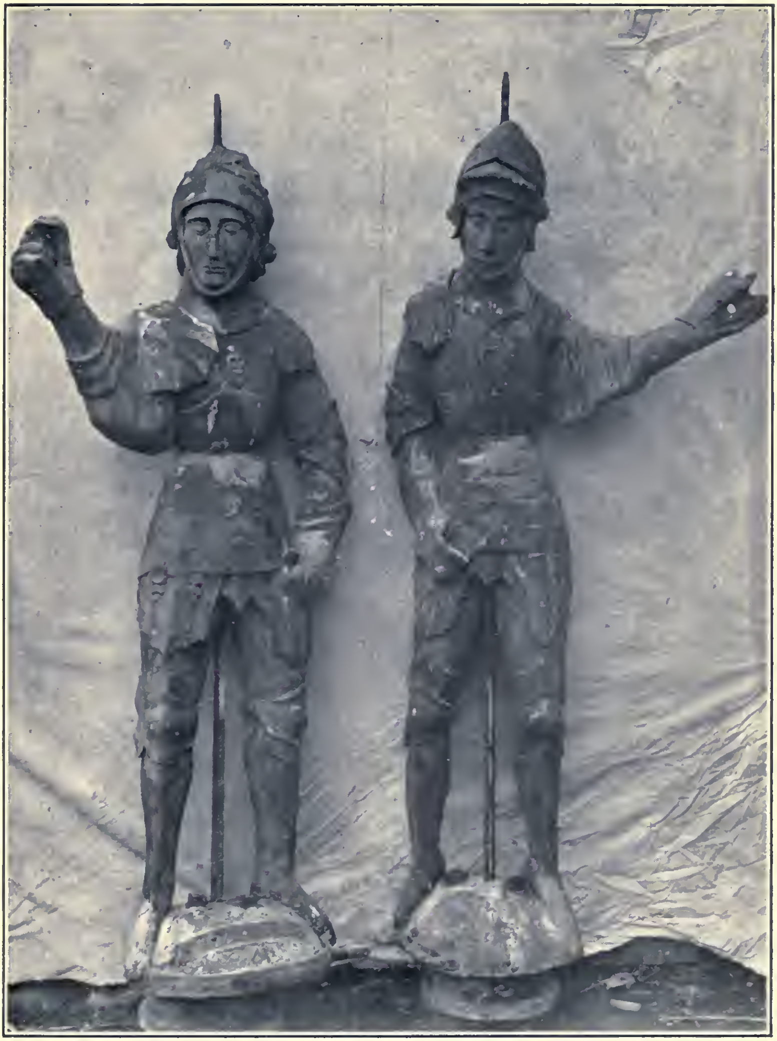

Plate IV.—Exterior Quarter-Jacks.

Photograph by Phillips] [8, Market Place, Wells

The author is unable to explain the circular disc which appears to have been let into the annular space between the rings where the arabic numeral 60 appears. It escapes notice from below but is plainly visible in a photograph.

DATES OF THE NUMERALS.

The Arabic numerals on the day and minute rings appear to belong to the 17th century, having presumably been repainted, and it may be that the words *Sic peragrat Phœbe* (see below) were renewed at the same time. The horary numerals, painted on large circular tablets, are of fine and bold Gothic character, but provide no definite evidence of date. They belong to pre-reformation times and are probably part of the original work.

If they are renewals they almost certainly follow the original design. Midnight and noon are represented by beautiful floriated crosses in place of numerals, and the style of these does not suggest late work.

THE STARRY FIRMAMENT.

The space between the minute-ring and the outer circular moulding surrounding the dials is painted blue and powdered with stars to represent the stellar firmament beyond the planets but this does not itself rotate.

THE FOUR WINDS.

In the four spandrels formed between the outermost circle of the clock-face and its surrounding square frame are angels, each holding a man's head. These are mentioned in descriptions but without comment or explanation, though the resemblance of the heads to the winds commonly represented in early maps is fairly obvious.

It is not very generally known that the winds formed an important feature in many illuminations illustrating the structure of the World. In the

Heidelberg Codex of St. Hildegard's "*Scivias*" (reproduced by Dr. Singer) is a rather conventional symbolic representation of the Universe. At each of the four corners, in the exact position that is occupied by the angels on the clock, are naked supernatural figures with wings and streaming hair. They are winged also above the ankles, and, being personified winds, they are active and muscular. Each is labelled with the name of the wind which he represents, and, what is more interesting to us, each bears in either hand a head of similar character labelled as a subsidiary or "collateral" wind. (See Fig. 3a, p. 35.)

These four cardinal winds each with his two collaterals are in accordance with the traditional Latin "Rose of the Twelve Winds," which, though it varies slightly, appears in this case as follows:—

CARDINAL WINDS.	COLLATERALS.
Subsolanus, E.	Eurus, E.S.E.
	Vulturnus, E.N.E.
Septentrio, N.	Aquilo, N.N.E.
	Circius, N.N.W.
Favonius, W.	Chorus, W.N.W.
	Affricus, W.S.W.
Auster, S.	Euro nothus, S.S.W.
	Euro auster, S.S.E.

It is easy to imagine the steps by which we should, at a later date, arrive at a representation of a single cardinal wind as a head held in the hand of an angel of the more usual type, no longer personifying a wind in herself. The later mediæval angel was generally feminine, as we see her on the clock, and had strangely varied tasks, from the honourable one of turning the Universe with a crank to the very mundane one of supporting a shield of arms on a tomb.

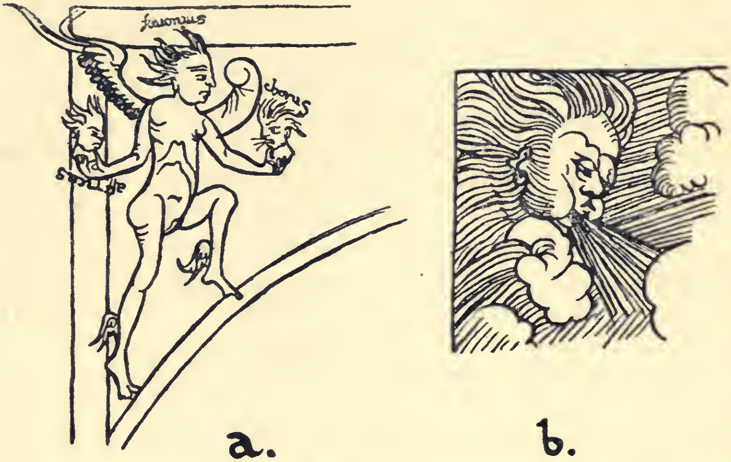

Fig. 3.—(a) Cardinal Wind with Collaterals from Hildegard's "Scivias."
(b) Cardinal Wind from 16th Century Dutch Bible.

There is therefore nothing incongruous in making angels hold personified winds, and there can be little doubt that this was the intention of the artist in the case of the Wells clock.

Very careful examination of a good photograph does indeed faintly reveal faded markings like the usual characteristic puffs and clouds, issuing from the mouths of two of the heads, though they are impossible to reproduce properly by half-tone process. The cheeks, too, are puffed out in the usual manner, which will be recognised in a more exaggerated form in Fig. 3b. (p. 35). This was copied from a drawing of the Universe in a 16th century Dutch Bible.

With the spread of Ptolemaic conceptions the idea of the winds as supplying the motive force of the rotating spheres was soon dropped, though they remained a customary feature in drawings of the Universe; there is therefore nothing unusual in the fact that these faces do not blow in such a direction as to produce rotation.

PHŒBE.

Opposite to the moon-opening on the innermost disc is a small circular medallion, on which is painted a quaint female figure symbolic of the Moon (Phœbe). A scroll partly surrounding the figure bears the inscription *Sic peragrat Phœbe* in bold characters such as were prevalent in Italy during the Rennaissance, when they gradually spread through Europe and provided the prototype for modern printing founts. The inscription appears to be of the 16th century, and it is possible that the whole medallion is late, but far more probable that the lettering has been repainted over old work; only careful examination at close quarters would decide the point.

Mr. Octavius Morgan, F.R.S., in the Archæological Journal for 1883 prints *Semper peragrat Phœbe*, and though a child could look up and read the letters *ic* with the naked eye, some writers on the clock have faithfully copied the error, with their eyes glued to the printed word. (The initial " S " is not quite so obvious.)

This inscription may be rendered " So progresses Phœbe." The medallion is pivoted and provided with a counterweight so that during the daily rotation of the moon-plate the figure of Phœbe always remains upright.

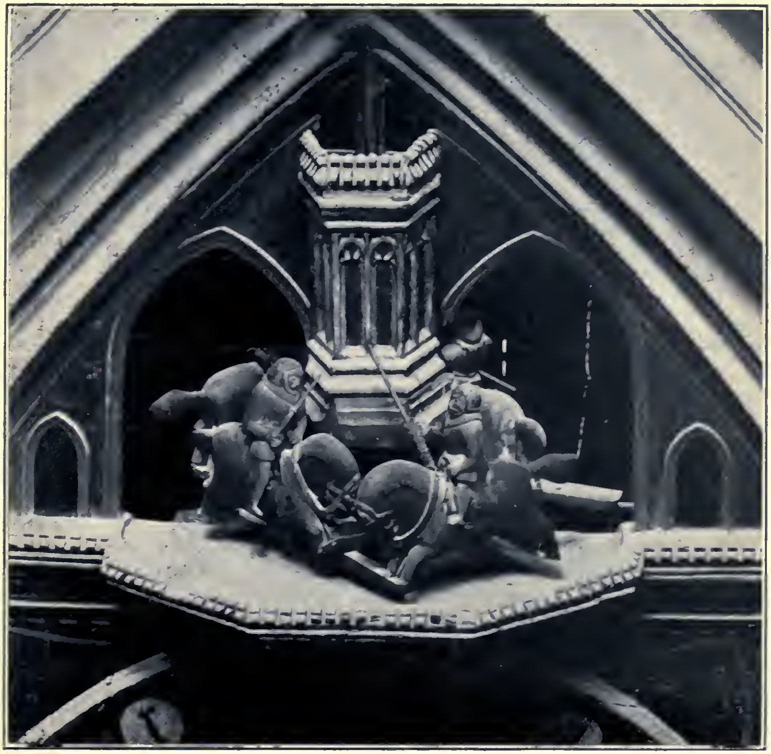

Plate V.—The Charging Horsemen.

Photograph by the Author]

The Moon's Motion.

A further fact that does not seem to have been previously noticed is that the moon-disc in its motion round the elemental spheres copies with wonderful similitude the double motion of the Moon with reference to the Earth. This follows from its attachment to the disc described as the moon-plate. (See above.)

The apparent daily rotation of the Moon round the Earth, now regarded as due to the real rotation of the Earth about its own axis, was, as we have seen, attributed to the Primum Mobile, but the monthly retrograde motion was accounted for by the supposed rotation of the moon's proper sphere. Accordingly we find, on analysing the resultant of the two motions imparted to the moon-disc by the mechanism of the clock, that the arrangement is ingeniously contrived so that the ring of the lunar days revolves once in a day, while the disc is carried round in the opposite direction once in a month.

As, however, the time of real rotation of the Moon about the Earth is not exactly 30 days, this clock, like others having lunation, needs to be adjusted once in a month, and it seems probable that the spheres of air (and fire?) are sculptured instead of being painted, in order to provide a handle for the monthly setting of the pointer.

Astronomical Summary.

To summarise the astronomical side of the horologe, we have the Earth at the centre surrounded by the spheres of air (and fire?), the Moon revolving round it in strict accordance with the Ptolemaic conceptions of her diurnal and proper motions, the sun making his journey round the Earth once in 24 hours, the starry firmament outside these and the four cardinal winds in their traditional places at the corners. In a perfect Ptolemaic microcosm the planets and the starry firmament would revolve also, but at a speed slightly different from that of the Sun, and the planets would describe epicycles of varying amplitude and period; but the mechanism to produce all these motions would defeat the resources of the highest ingenuity and the heaviest purse.

JACK BLANDIFER.

In the triforium above the clock-face and northward of it is a large oaken figure that strikes bells at the hours and quarters with its heels, and was formerly arranged to hit a third bell at each hour with a hammer held in its hand. According to Canon Church this quaint and grave figure is locally known as Jack Blandifer, though a slightly different spelling is given below. Members of his brotherhood are commonly called jacks or quarter-jacks, and Britten tells us that they were probably used before dials. (See Plate II., end of Preface).

Speaking of two at Dijon he says that they are still locally known as *Jacquemarts*, and derives this name from *Jaccomarchiadus*, a man, a suit of armour. He rather seems to imply that "Jack" comes from the same source. Murray's New English Dictionary, however, shows the evolution of "jack" from the bye-name or familiar equivalent of John to its later use for an appliance that mechanically does a man's work, e.g., a spit-jack or a screw-jack. The intermediate or transitional general application is to a man, or to a figure of a man arranged to do something automatically, and in particular a figure designed to strike a bell.

It is a pity that Jack Blandifer is not allowed to use his hammer, and one could wish that he should again do his full devoir at times when there is no service in progress. The fact that the original works at South Kensington (see below) have exactly the right provision for the full performance of this jack certainly suggests that if he personally does not belong to the original clock a predecessor carried out the same duties.

At a cursory glance he would certainly be assigned to the reign of Charles I., but a careful examination shows details of costume that might be earlier, and his late appearance may be due chiefly to his face having been repainted in the first half of the 17th century. His hat has some resemblance to types of the late 14th and early 15th centuries, and the full sleeves narrowing at the wrist look mediæval. A puzzling feature is his hair, the conventional treatment of which has a mediæval appearance, though the fashion suggests a later date. His shoes are of late cut, but his hinged legs may well have been renewed, making them valueless as a guide. The arched wooden sentry-box in which he sits is of the depressed four-centred style, and may be late Mediæval, Tudor or even Stuart.

Mr. R. Griffin and others agree with the author that Jack is no more certainly communicative as to the date of his birth than his more warlike equestrian friends on the top of the clock (see below) ; but Canon Church seems to favour the view that he belongs to the 15th or late 14th century, and has been repainted and repaired. Considering all these points, this view seems the most reasonable one.

THE EXTERIOR QUARTER-JACKS AND DIAL.

Outside the north transept are two other quarter-jacks, four feet in height, of solid oak and finely carved. They strike the bells with axes, each figure being turned bodily for the purpose through a small angle about a vertical spindle. (See Plates III. & IV. pp. 28 & 32). Mr. Octavius Morgan, in the very inaccurate article quoted above, says that they date from the supposed re-erection of the clock at Wells after its removal from Glastonbury in the reign of Henry VIII. Again, the guide-books quote without correction, though the armour affords a fine example of an obviously earlier period.

Mr. St. John Hope gave them the date circa 1460-80, but Colonel Bramble, formerly President of the Somersetshire Archæological Society, in an able and elaborate account of the armour incorporated in Canon Church's paper, gave the date 1485-90. There is no other feature of the horologe that can be so closely dated as these beautifully sculptured jacks.

The exterior dial, like the interior one, was originally divided into twenty-four hours, but it has been replaced by a comparatively modern twelve-hour face bearing the emblems of the Evangelists.

The Charging Horsemen.

Above the pediment of the interior face is a wooden turret in the Gothic style, standing in the midst of an octagonal battlemented platform arranged to serve the purpose of lists for the famous little horsemen who tourney round the turret every hour, driven by a mechanism with a separate weight. (See Plates I., V. and VI., Frontispiece, pp. 36 and 44). The Rev. Percy Dearmer in his guide (Bell's Cathedral Series) describes the performance inside the transept in words that cannot be bettered:—

"'Jack Blandiver' (this is the name given him by the country-folk for some undiscovered reason) kicks his bells at each quarter in the most life-like manner, his feet trembling afterwards with the exertion; but at the hour, after Jack has sounded his four quarters, as the big bell begins to toll, the four 'knights' above the clock rush round in contrary directions, and charge each other with so much ferocity that one unfortunate is felled at each encounter, and has barely time to recover his upright position before he is again knocked down with resounding clatter upon his horse's back. The other three fight twenty-four times a day unscathed."

According to Britten, J. R. Planché, the well-known 19th Century authority on costume, says that these figures have undergone strange transformations.

One, he says, has a hood with ears to it, one is nondescript, and another wears the civil costume of James I. or Charles I., with falling collar, striped doublet, peaked beard and moustache. This last is seen on the left in Plate I. Mr. Octavius Morgan alludes to the common description of them as knights, and says that they merely wear ordinary civilian garb; but there can be little doubt that the one on the right in Plate V. has a helmet, though the date is difficult to fix. In his hand is a spear, which he has evidently broken in his martial ardour, as the telephotograph clearly shows a piece of wood coarsely spliced on with string. Mr. Frederick Parker, of the Cathedral, to whom I am greatly indebted for valuable information received in correspondence with him, tells me that this was done in 1920.

The figure approaching him from the left carries a broken spear or short sword and is mounted on a spindle, so that when the helmeted adversary smites him he falls backwards flat on his horse as he is seen on the left in Plate V. and in the middle in Plate VI.

On passing behind the turret he is automatically set up again, only to receive another "knock-out blow," and so on, in rapid succession during several encounters, with most comic effect.

He is the hero with an "eared hood," and it is difficult to see what other head-gear can be intended, unless it is a grotesque helmet, though well-known antiquaries tell me that they never encountered a head-dress of this type.

The author has found one example of an eared hood in a 16th century wood-cut showing a school. In this the ears are much longer than those in question. Still longer ones with bells on the tips are shown in Sebastian Brant's "Stultifera Navis," 1497, and elsewhere; but all these clearly belong to the fool's habit. It is to be feared that the eared hoods of the schoolmaster and his scholars were also intended satirically.

The effect of all the figures is most quaint, and the ears on this hood, if such it be, give the long-suffering wearer some resemblance to a dormouse. The turret, the platform, and the small arched and painted wooden screen which partly fills the space between them and the stonework, and through which the horsemen pass back and forth in their career, are all of early perpendicular type, quite compatible with the date 1394, and show that both they and the mechanism for carrying round the figures are contemporary with the clock, even if one or more figures have been renewed. The author has not found the reference in Planché, whose works are voluminous and badly indexed.

THE MECHANISM.

The horologium at Wells must have been one of the most important pieces of complete ancient mechanism extant until about 1835-39, when owing, it is said, to bad time-keeping, the works were replaced by a modern movement. This failed in turn, and in 1880 yet another movement was installed, and still operates the dials, the moon disc, the quarter-jacks and the charging horsemen. In the meantime the original works were deposited in the crypt under the chapter house, where they remained uncared for during many years.

Mr. Morgan in 1883 wrote: "The remainder of the works were all disjointed and bent and remained unheeded, though on two occasions I pointed out the great curiosity and interest of the ancient machinery but with no effect. Its curiosity and interest has at length been appreciated, and it has been fitted together and brought up to London. It is now in going condition in the Mechanical Museum at South Kensington. If the fabric rolls of the

Cathedral were examined with reference to it, it is probable that much curious and interesting matter relating to its history might be found." (See Plate VII. p. 48.)

We have seen this prediction fulfilled by the discovery in the Wells rolls, and we owe a great debt of gratitude to Mr. Morgan for rousing the interest which resulted in the loan in October, 1871, of the works by the Dean and Chapter to the Old Patent Office Museum, from whence they were moved to the Science Museum in about 1884; there they are exhibited to this day working and striking the hours on large bells. The original work was straightened and put in order and a few lost wheels were replaced in brass.

We may feel some regret at this separation of the priceless machinery at Kensington from the visible parts of the clock, but there is ample consolation, especially for the Londoner, who may now watch the slow rotation of the wheels, governed by a modern escapement but otherwise untouched, and may wait as the hours approach, for the lifting of levers, the clatter of ratchet and pawl, the whirr of the fly and the boom of the bells, and think of the events which have been measured out, tick by tick, during five centuries, or try to estimate the number of revolutions which this or that wheel may claim as its lifework. This venerable mechanism has fallen upon easy times. It is now at work only during the hours in which the museum is open, and enjoys a long night of well-earned rest when the attendants leave.

It occupies a space of about five feet cube, and is entirely made of forged iron fastened by mortice and tenon and cotter, without any screws. The wrought-iron wheels in the time-keeping part of the mechanism are about half-an-inch thick, and one, having ninety teeth, is as much as two feet in diameter; the pinions are of "lantern" form and all working parts are a wonder of accuracy and truth.

A great wheel in the striking train has 64 teeth, is three-quarters of an inch thick and more than 32 inches in diameter.

The striking movement is driven by two separate weights, each acting on its own drum, one being for the two quarter-strokes and the other for the hours; thus it will be seen that there are three weights requiring to be wound up. The striking gear works on the locking-plate principle still largely employed in French striking clocks.

Originally the clock was controlled by a verge-and-balance escapement; but at some time subsequent to the application of the pendulum to clocks by Galileo in the middle of the seventeenth century a pendulum and anchor were fitted in place of the balance and verge.

The verge is a vertical rod, having two pallets which engage alternately with the teeth of the crown wheel. It is suspended by a cord to decrease the wear on the bottom pivot and at its upper end it carries the balance, (the cross-bar alluded to in the poem) provided with weights placed equi-distantly on either side of the verge and hung from notches cut in the bar so that the distance from the centre can thus be altered and the moment of inertia of the balance made adjustable for regulation. Rotation of the wheel-work can only take place by producing a slow vibratory motion of the balance by means of the pallets.

An excellent example of the verge escapement may be seen in a very early striking clock, probably made in Switzerland, circa 1348, and formerly at Dover Castle. This clock is one of the earliest in existence, and may be seen in the same Museum with

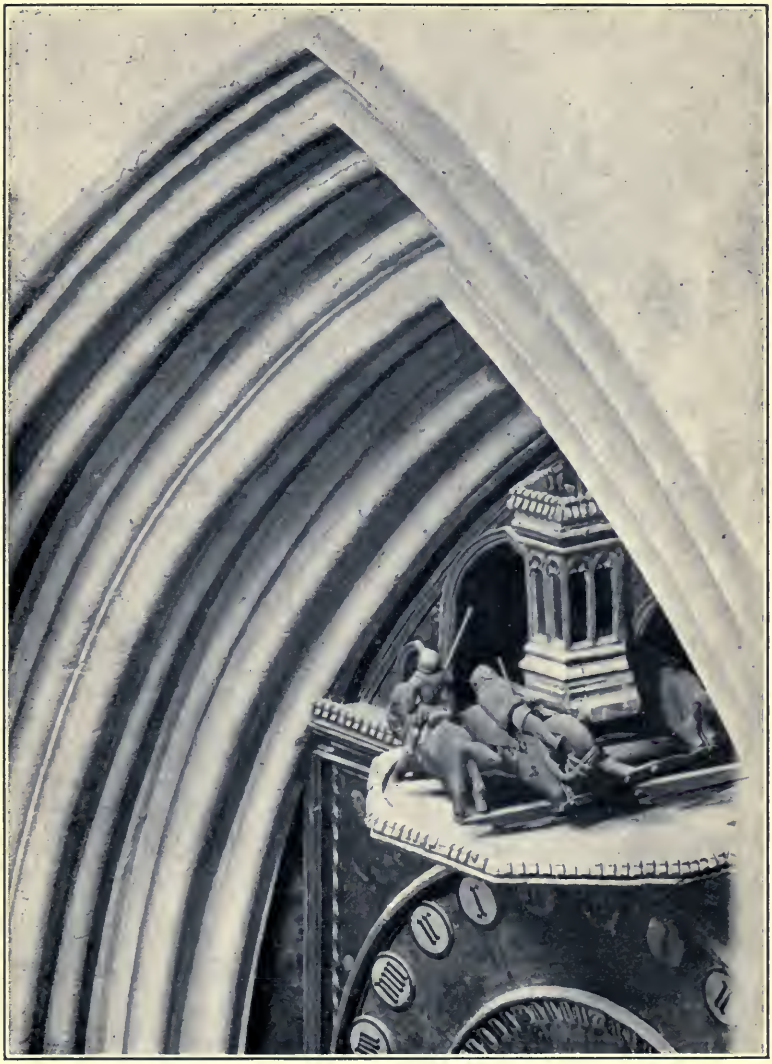

Plate VI.—"The Knock-out Blow."

Photograph by the Author]

the Wells movement at South Kensington. Near it is a small Japanese clock with an escapement of this form at work.

Lightfoot shows the Abbot his escapement balance in Miss Harris' illustration on the cover.

Quaint wooden clocks working on the same principle are made in the Black Forest to this day, and are commonly painted with the date 1640. This would appear to be traditional, as no amount of dirt or stain could deceive a sane purchaser, nor does any such deception seem to be intended.

According to Britten the Wells clock, except for the lunation work and the striking part, is identical with the clock made by Henry de Vick, of Wurtemberg and erected at Paris in 1380; the exceptions, however, are important, and in any case the exterior face of the famous Parisian movement is all new.

Mr. J. J. Hall suggests that the dial of the clock at Exeter Cathedral dates from 1317, though this is unlikely. It is said, too, that part of the clock at Ottery St. Mary, Devon, goes back to 1340. But the old clock at Wells can hold the field against any of these when all its claims to antiquity, elaboration, beauty and quaintness receive their due. There are, it is true, more elaborate examples, such as that at Strassburg, but they are of much later date, and it is surely no exaggeration to say that he who knows the work at Wells and the movement at Kensington knows the most wonderful thing of its kind in existence.

SUMMARY OF DATES AND EVIDENTIAL FEATURES.

Erection of Glastonbury Clock by Lightfoot.		Circa 1325.
First record of payments to custodian of Wells Clock		1394.
Works at Kensington (except escapement, pendulum, and a few wheels)		Shortly before 1394. Made by Lightfoot's successors at Glaston ?
Main features of interior dials.		
Circular inscription *Sphericus*, etc.		
Stone supporting-screen.		
Turret, platform, arches and mechanism for the horsemen.		
Paintings of the four cardinal winds shown as angels holding heads.		
Painting of *Phœbe*.		C. 1394 or later ?
Painting of boards at back of works.		15th Cent.?
Gothic horary numerals.		1394 or 15th Cent.?
Horseman with "eared hood."	Replacing earlier figures ?	Circa 1394 or Circa 1500 ?
Horseman with helmet.		
Interior quarter-jack.		Mediæval or 17th Cent.?
Exterior quarter-jacks (replacing earlier figures ?)		1485-90.
Destruction of Glastonbury clock.		Circa 1539.
Inscription *Sic peragrat Phœbe* (replacing earlier inscription ?)		16th Century.
Arabic numerals for minutes and for days of month (presumably replacing earlier numerals ?)		17th Century.

Horseman (in hat and collar) replacing earlier figure. ...	17th Century, First half.
Repainting of interior jack. (Assuming the figure earlier.) ...	Do.
Legs of interior jack. ...	Do.?
Escapement at South Kensington. (After Galileo's invention of pendulum in middle of 17th century.)	17th Century.
Removal of works to crypt and provision of modern movement.	Circa 1883.
Original movement lent by Dean and Chapter to old Patent Office Museum.	Oct. 1871.
Old wheels straightened, whole put in going order in Museum, bells provided and few new brass wheels fitted.	Circa 1871.
Second modern renewal of interior movement at Wells. ...	1880.
Original movement transferred from Patent Office Museum to Science Museum at South Kensington.	Circa 1883.
Discovery by Canon Church of annual payments for upkeep of clock dating from 1394. ...	Circa 1909.

CONCLUSIONS.

1. There is no single feature of the present clock at Wells and Kensington that can be safely dated earlier than 1394.

2. There is much that is quite in keeping with the supposition that the main part of work was finished by 1394, and there are some details that are unlikely to be much later than 1394.

3. As the Chapter Rolls prove the existence of a clock at Wells in 1394, we cannot accept the theory that the Glastonbury clock was removed to Wells when the Abbey was dissolved. This is made quite clear by Canon Church, and we must unfortunately hold that Lightfoot's clock as described by John of Glaston, was utterly lost when the Abbey was destroyed.

4. The evidence of the Rolls and conclusion No. 2 justify the belief that the most important features of the present clock were finished by 1394, as it is unlikely that a new clock would be installed a few years after the erection of one important enough to cost 10/- per annum for upkeep.

5. There were several renewals and partial redecorations in the 15th, 16th, 17th and 19th centuries.

6. It is, on the whole, likely that the clock was constructed at Glastonbury in workshops made famous by the monk Peter Lightfoot and by craftsmen following his traditions, and it is possible that he even had a hand in the design, though his age at the earliest *recorded* date of the clock would be 89, even if he were only 20 when he made the lost Glastonbury horologe.

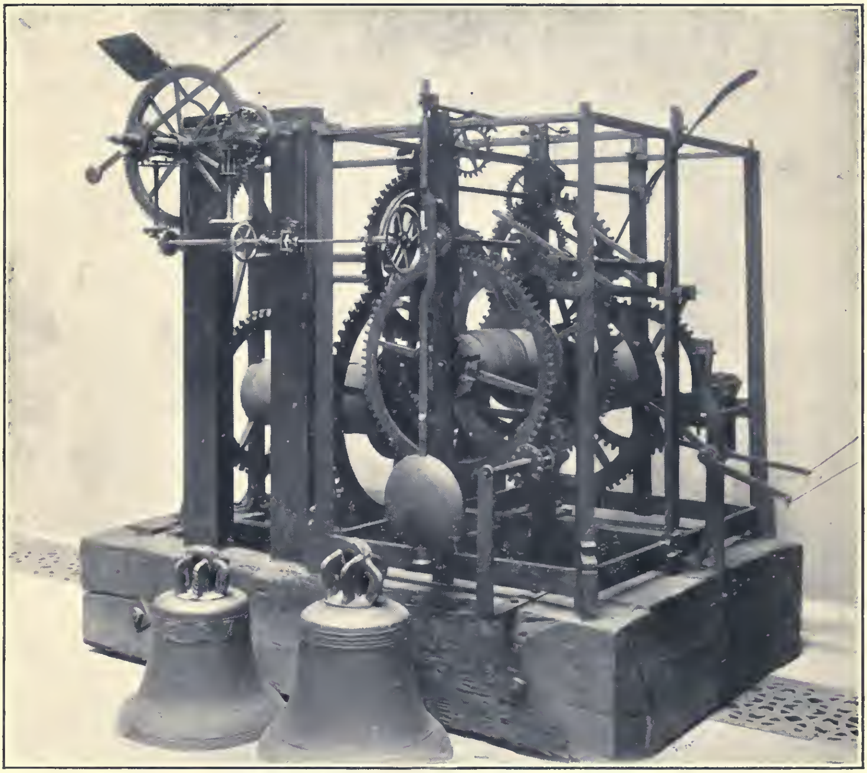

Plate VII.—Original Works at South Kensington Science Museum.

Photograph supplied by Museum Authorities] [By kind permission

7. The front affords a fairly complete exposition of mediæval cosmography, the foregoing notes providing what seem to be new explanations relating to five features that would otherwise remain comparatively meaningless, but now reveal the clock far more completely as a microcosm of the Ptolemaic Universe. These are:

   (a) The wavy rose-like sculpture surrounding the terrestial ball and probably representative of the elemental spheres of air (and fire ?) surrounding the more tangible elements of earth and water.

   (b) The angels holding heads in the spandrels—almost certainly personifications of the four cardinal winds.

   (c) The sun at the extremity of the horary dial-pointer, generally described as a "large gilt star." This revolves round the earth once in 24 hours.

   (d) The "buckle-shaped" pointer representing a crescent-moon to show that the index emerging from its concave side points out the age of the moon.

   (e) The fact that the waxing and waning moon-disc moves round the elemental spheres at a rate which combines most ingeniously the moon's right-handed (Ptolemaic) diurnal rotation with her monthly retrograde or left-handed rotation, the inexact ratio of lunar month to solar day being adjustable by turning the embossed elemental spheres at the centre.

* * * * * * * * * * * *

There is no attempt to indicate the other planetary spheres, the Primum Mobile or the Empyrean Heaven, and the starry firmament is stationary.

PETER LIGHTFOOT.

GLASTONBURY ABBEY. A.D. 1325.

Peter Lightfoot speaketh.

FULKE from the cloister with a message comes.
He saith: Our Lord the Abbot would have speech
With Peter Lightfoot touching certain sums
That Wells and Wimborne offer should he teach His craft.
I will attend the Abbot now.

My Lord! 'Tis good the ancient feud is healed
With Wells, but, Holy Father, while I bow
To thy commandments, I am loth to yield
To these proud seculars the thing they ask.
Let them find money meet for us to make
The horologe they want; so shall the task
Be Glaston's glory for Our Lady's sake.

Yea! All is well; the greatest wheel doth turn
And truly with his fellow wheel engage
And this with ease; but lest the forge should burn
A bar that waiteth, with too fiery rage,
I would return to Fulke, thy messenger,
Who stayed to blow while I obeyed thy call
And lacking kind-wit,* will not rightly stir
The embers but will mar the piece withal.

Lightfoot, back at the forges, answereth Fulke's raillery.

Peace, Brother Fulke! thy dregs of wit run dry
To mock my labour in the forges' heat!
Thou Judge of Crafts, who dost exalt on high
The simple spit that Ambrose there doth beat
With Hugh's great iron gate whereon the Saint
In helm and hawberk slays the wingèd worm!**

---

* "Kind-wit"—"kynde-witte"=natural sense or common sense.

** A.S. "Wyrm" stood equally for "worm," "serpent" or "dragon." The "Evil Worm" was a common name for Satan.

"No craftsman," say'st thou,—for that I nor paint
Nor, seeing deep in marble some dim form
The mind hath moulded, free the prisoned face
With searching chisel? True! I lack the touch
Of Brother Hugh whose hammer-strokes enlace
Yon dragon's tail with leaves—whose spirit such
High Kingship wieldeth, wedding hand and eye!
For Ambrose?—Let him fashion spit or bar
And shoe the Abbot's palfreys.—Let him ply
His father's mystery* and not too far
Pursue the craft, who hath but smithy lore.
But I, that did conceive in hidden thought
This cunning engine, of my travail bore
Each giant wheel with teeth all justly wrought
To Fellowship, yet must I fill, forsooth,
The half spilt ale-pot of thy drasty wit**
With milder brewing, measured to thy youth!
A question, like a roasted crab shall sit
Therein to vex thy lips! Dost deem our lord
The Abbot Adam, loving every Art,
Searching all skill the Convent may afford,
Would build these mighty bellows, set apart
For me, without an end? Thy answer seek
Among the novices; or in the town
Pursue the quest; with Ralph the porter speak!
Go! Match thy wits with some uncloistered
    clown
Down in the market; even there men praise
Adam of Sodbury, though few may know
Of Petrus Lightfoot!

                    Fulke doth wend his ways
And I must work apace, for e'er I go
To Vespers I would forge the axle-tree
That beareth up the cross-bar's swinging load
In notches.—Lord, how often must I see
Thy slow diurnal Heavens, in their mode
Revolve about the great unmoving Earth?

---

* "Mystery"—craft or trade.

** "Drasty," trashy, worthless. ("Drast"=dregs.)

How often will the moon her proper sphere
Encompass, waxing from her crescent birth
In growing silver glory till as near
Doth seem Her Heaven as a lark might wing
His praise? How often will she sadly wane
To black engulfing night e'er I may bring
My horologe to trial? Scarcely vain
Can be the labour, for as minutes go
In sure procession through each creeping hour,
So surely must the cross-bar to and fro
Swing, time-true as the bell in Dunstan Tower,
Tight-reining all the wheels that else would race
To whirling ruin, and there's nought can fail
'Twixt the great weight, the cross-bar and the face
Where each slow index counts the endless tale
Of days or hours or minutes. Brother John,
Who paints the vaulting, shall the front enrich
With twenty-four great numbers and anon
I must take counsel with myself what pitch
And size the teeth and wheels are like to need
To whirl my warlike puppets in their course
Of tourneying above; there must they speed
With mimic valour. One shall ride his horse,
Held at his middle by a spindle-pin,
And when his fellow smiteth him full sore
The dint shall fling him back, but he must win
His seat behind the turret and once more
Be felled, and fight again; and this conceit
Will please full many who, like Fulke, do fly
The falcon of their mirth at quarry meet
For groundling minds that soar not over high.
Yet gentle laughter oft the hours will greet
When simple pilgrim folk and Glaston men
See him who sits with spurred and booted feet
To beat the quarters on the bells or when
These tilting knaves do battle with their spears.
Clean through the dial of the days must be
A circle cut wherein the moon appears
In aspect rightly set that all may see
From day to day how creeps a crescent thin

Of gold that waxes to a perfect round
And wanes in order. John must soon begin
To deck the front; his fancy doth abound
In quaint conceits of birds and angel-shapes
For vaulting cells; in Latin he is sage
And painteth letters and he maketh apes
And monsters to enrich the missal page.

Some days, lame-footed, limp their weary way
To darkness and but little seemeth done,
Till eager, hot-foot hours renew the fray,
Do battle with the task, and Hope is won;
I dream of finished work and see it live
A stranger life than painted wall or beam
Or sculpture knows. Your artist cannot give
Such ordered motion.—His the frozen dream
In marble, or the still, eternal gaze
Of pictured saints, though higher doth he aim
His flight than I.—Yet far off unborn days
Will gather into centuries,—the fame
Of artist and of craftsman come to nought,
And still the iron heart will beat and beat
Through sunny years of peace, through battles fought
For good or evil causes, while the feet
Of myriads pass who pause to see or hear
The march of Time. Great kingdoms shall burn out
Like guttered candles; men shall know pale Fear,
Love found through Hate and Faith through darkest Doubt
And Wisdom new, while still it beats, and so
Shall not my work find favour in God's sight ?
Ah ! Virgin Mother, grant it !
Now I go
At Dunstan Bell's deep summons. This same night
It may be that our Blessed Lady's grace
Through the dark dormitory will descend
In glory ! Dare I hope ? Nay ! will her face
Reward my spirit even at the end

Of Life's long road? Who knows? Our Sacrist lay
One night and through the bars a moonbeam crept
Across the wall where 'twas his wont to pray
Before the *Mater Dei* e'er he slept.
Her face but dimly flickered in the light
Cast by the cresset-stone,* for not as yet
Were Matins. He, who had not done aright
In some small matter unconfessed, did set
His soul to wakeful penance till such time
As this soft ray should steal across the wall
And light the image. Long the moon did climb
Her winter arch and ever bright and small
The lambent fleck would wreathe and change its hue
Like vapour, though the window-splay was wide
And clear the glass. At last the moonbeam blue,
Flashed like our sunlit mere and down did glide
Swift music of the crystal spheres; the ray
Flung o'er the image blue and silver light—
Our Lady's colours! Then, like dawning day,
The sculptured figure flushed, till life ran bright
In face and eyes, and fine gold-threaded hair
Stirred in the moonbeam as it were a breeze!
For one brief minute's space was he aware
Of bliss undreamed of. Swiftly to his knees
He rose; the vision faded into night;
The faint red flicker from the cresset-stone
Played but on painted wood; no other light
Or sound was there, yet seemed he not alone,
The Sacrist telleth us, and ripe in years
And wise he is and ever loveth Truth.
Such visions, won through penances and tears,
Might yet reward my work! Oh! Lord, have ruth

---

* Cresset-stones took various forms but were commonly plain slabs with several cup-like hollows containing wicks lying in fat or crude oil so as to form a multiple lamp. They were placed at dark corners in passages or dormitories to guide the monks on their way to the Church for Matins, a service formerly taken at midnight in monasteries. An excellent example remains in Brecon Priory Church.

For vain presumption! Yet the toil and heat
Are Thine alone and Thine the ancient zest
Of poring o'er the cramped and faded sheet
Of Sacrobosco* or the Almagest
To learn the secret of the whirling spheres.
Ten heavens reach, through ever vaster span,
The limitless Empyrean where God hears
Their rushing music. This the ear of man
Doth grossly miss, but I have learned the arts
Of computation and have sought the link
Betwixt the Microcosmic Body's parts
And all God's Universe and on the brink
Of some great knowledge I have thought I stood.
Had Roger Bacon walked his own great way
To Wisdom; had the Church believed it good;
Had men but seen that knowledge is a ray
That lighteth them to God!—but what is gained
From grievous thoughts? One thing I fain would
test:—
There was a Picard knight who late attained
Great honour with the few who keep the quest
For learning; Roger praised him and his name
Was Petrus, like mine own, and he was called
The "Pilgrim" and the work that gave him fame
Reveals strange virtues that Our Lord installed
In *Magnes Lapis*,** that rare, mystic stone
Of mariners. Now Petrus seems to see
Great matter in the strange compulsion shown
Betwixt the magnet and the axle-tree
Whereon the heavens whirl and he doth take
A perfect sphere of stone, made free to turn
By nicest balance; pivots doth he make
For hollows on the ball, but men must learn
Where lie the active poles upon the sphere
And there must make the pivot-hollows true.
The whole must be set up in brazen gear

---

* Johannes de Sacrobosco or John of Holywood or Halifax, an early writer on Astronomy who originated little but accumulated much, opening up a new world of knowledge and thought to countless students and remaining for some centuries a highly popular authority on the subject.

** "Magnes Lapis." The ancient name for the lodestone or natural magnet.

And as the poles of Heaven will endue
The stone with sympathy, it must be laid
So that the axis pointeth to the star
That guideth seamen. When 'tis truly made
The whirling Heavens working from afar
Should keep it turning like the firmament
Once wholly in a day. If this be so
The engine doth a horologe present
That never stoppeth and will ever show
The hours throughout the day, but I do doubt
The Abbot ne'er will grant me grinding wheels
Or magnet stones. He will not dare to flout
The fear of witchcraft, and he ever deals
With open honesty, so cannot stoop
To secret trials:
                    Lo! The Office ends
With dying echoes; forth the brothers troop.
For thoughts that wandered I must make
    amends;
And though too near the Earth my soul doth live,
                God will forgive!

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